

PRACTICAL MUNICIPAL MILK EXAMINATIONS.

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Much has been written concerning the bacteriological and cellular content of milk, and in how far counts thereof are accurate. Four years ago, under Dr. A. C. Abbott, of Philadelphia, we learned the technique and value of the Stewart centrifugal method, and we have since applied it to an average of 3,000 specimens yearly; after the first year, making the hard and fast rule that the presence of pus and streptococci combined in any sample should immediately result in shutting the source of that sample from the market until the trouble had been rectified, as shown by a second microscopical examination. The presence of dirt in consecutive samples, as shown by the presence of *B. subtilis* and allied organisms, together with confirmatory data from farm inspection, also came under the same rule unless attempts were made to correct the conditions. Otherwise, findings of pus alone, streptococci alone, blood, occasional dirt, or any combination of these, resulted in a warning being sent to the producer, which stated the findings and requested that the cause be located and corrected. Out of 500 producers, six went out of business the first year rather than clean up, while two discontinued business rather than locate infected milk. Since then we have had immediate response to requests for the correction of even minor troubles, and in every case but one, the source of the infected milk was located, usually by the producer, and less often by a veterinary. The one exception noted was in the case of a cow which showed nothing on physical examination and which was voluntarily cut out of the herd by the producer and sold for beef.

The first year, whenever pus or pus-producing organisms were found in any mixed sample of milk, we examined samples from individual cows, or from an entire herd if the producer suspected no particular animal, controlling the results by testing the herd individually before and after the trouble was located. In the majority of cases the producer picked out the animal at fault, while in a minor number corroboration of results was given by veterinarians.

By pus and streptococci we mean a very definite picture, i. e., the presence of polymorphonuclear leucocytes in any number whatsoever, but clumped,—that is, held together by the fibrin content. We regard only the

long chain variety of streptococci, of a type of which we shall mention later, as significant. In making smears of milk sediments by the Stewart method, we may find a stringy sediment which will give masses of pus cells from dozens to hundreds in the field, or we may find a sediment which is not ropey, but which shows on an average a half dozen pus cells, clumped. This, we most frequently find, depends on the volume of milk from which the sample came; that is, whether it was from the mixed milk of a small producer, or, on the other hand, whether it came from the mixed milk of one or more of the larger producers,—frequently, for example, from the mixed product of a dairy. In some cases pus in milk has been traced to tuberculous cows, in other cases to cows whose teats had been bruised. In such cases, a sample from the individual cow has shown the characteristic picture, not of small clumps, but of large clumps, where experienced judgment is not needed to say that there is some real trouble. In this connection we would emphasize the point that there are samples which show the characteristic clumped pus cells, but no streptococci. Incubation of such samples shows the causative organism. In a less proportion of cases where pus and streptococci are found, we find the presence of endothelial as well as polymorphonuclear neutrophilic cells; a picture not like the definite one previously described. These cases we have followed up and found all of them, thus far, to be from cows from two to five months previous to calving which have previously had garget, or which are out of condition, or tuberculous. In but one specimen out of 12,000 have we found the presence of staphylococci with pus. In a minor number we have found the prevailing pus cell not the neutrophile, but the eosinophile. In regard to what that picture represents, other than indicating inflammation, we have no data to offer.

Pus alone has resolved itself, either into a picture of clumped polymorphonuclear cells, where, on incubation, we find the causative organism, or one with isolated polymorphonuclear cells, the number of which may be hundreds per field. Yet in no case has the streptococcus been found in the latter picture, even on incubation, nor has evidence of cow trouble been found on physical examination. In some milk sediments we found a cell similar to the polymorphonuclear in size, but mononuclear and of non-granular protoplasm. This type of cell we have never found clumped, nor have we been able to trace any cow trouble in such milks, even where the cell content may be hundreds per field.

Streptococci alone furnish a large field for investigation. There are apparently numerous varieties of short and long chain streptococci. Of the former there is one type where the individual cocci in the chain are of varying size; these we class with the dirt organisms. The other common

type, where the individual cocci are of even size and small, we believe are forms of the lactic acid bacillus. Similarly, with the long chain streptococci we feel sure of two types: the first type, where the individual cocci are of the same size, and where the chains are coiled, we have yet to find without the association of pus cells, though, as we have stated, where pus cells alone are present, we may find them only on incubation. In the second type, the streptococci are similar to the varying sized individual cocci of the short chain variety and like them are classed as dirt organisms. Frequently one finds straight long chains of even sized streptococci but the chains are not as long, they are not found coiled, and have quite a different appearance from either of the two varieties previously mentioned. We have not found any cow trouble where such streptococci have been present in milk samples, nor have we discovered such a finding in milk samples which have been sent to the laboratory from sick rooms. We attach no importance to this type of streptococci in milk smears.

To summarize: One may examine the majority of specimens of market milk by the smear method and find them without appreciable cell content, and often without any demonstrable bacterial content, while the minority will give pictures such as we have described, and the samples from individual cows will give the same contrasting pictures, thus furnishing data by which infected cows can be discovered and isolated. We therefore believe that we have the most practical, quickest, and above all, an exceedingly thorough method, for demonstrating clean and contaminated milk.

The following is a common experience which illustrates the lack of value of numerical counts alone: A sample of milk sent to the laboratory, suspected to be the cause of an infant's illness, was found to contain pus and streptococci. The source proved to be from the best sanitary nursery-milk dairy in that part of the state. A control sample was taken immediately from the nearest source, and the same findings were recorded. Because of the progressiveness of the producer, he was personally interviewed. The laboratory findings and their meaning were laughed at by the producer and his weekly bacterial count of the nursery milk, made by an authority, was shown the writer. This report had just come in that morning, and the count, standing at but a few thousand, bore with it the statement from the authority that it was the best count that he had ever made. After much discussion, the producer called up his manager, asking him to find out what had been done with a certain cow that had been ordered out of the herd because one teat had been bruised by being stepped on. The manager found that on the previous day a green hand had

included the milk from that particular cow with the market milk. A sample from that cow and one from the remainder of the herd confirmed the previous finding. The year following, while the same producer was away for some days, we found his nursery milk showing pus and streptococci. Before the next milking the infected cow was found by this method, and later the finding was confirmed by physical examination. This brings up two points that are important; first, that while a producer's milk supply may be officially shut out from the city because of the presence of pus and streptococci in his market milk, yet from the speed with which samples from animals suspected or known to be infected can be examined by the laboratory, the trouble can be rectified in time to allow the next milking to come into the city; second, that the producers have kept a much closer watch on even minor cow troubles, as shown by the frequency with which producers during the past two years have sent in samples from cows which have been isolated, either because of known trouble, or to find out if the trouble has entirely cleared up, or because the producer was suspicious of some trouble of which he could find no evidence on physical examination. We have been assured by several producers that the laboratory has proved to be a most valuable aid to them in protecting their milk supplies.

The percentages of contaminated and dirty milks that we have found the past four years are of interest:

1907, pus and streptococci	5. %	dirt, 37%
1908, " " "	2.5%	" 26%
1909, " " "	1.8%	" 23%
1910, " " "	.14%	" 12%

Following are the statistics of mortality from infantile diarrheal diseases:

Periods	Births	Deaths Under 1 Year	Deaths Under 5 Years
1887-1890	9,748	383 or 3.92%	465 or 4.84%
1891-1894	10,623	445 or 4.19%	526 or 5.46%
1895-1898	11,512	457 or 3.96%	581 or 5.04%
1899-1902	11,469	411 or 3.58%	524 or 4.56%
1903-1906	12,589	437 or 3.47%	522 or 4.14%
1907-1910	14,264	367 or 2.58%	426 or 2.98%

Put in another form, for the periods designated, these statistics show that there have died from infantile diarrheal diseases, respectively one out of every 25, 23, 25, 27, 28 and 39 children born. During the last period, which is that during which milk examinations have been made, the infantile mortality for the periods under 1 year and under 5 years of age from diarrheal

diseases, contrasted with five previous periods of similar duration, has been cut very nearly in halves. This, in the absence of any other apparent factors at work, we believe is the result of milk inspection, and the Stewart method of milk sediment examination. While we believe that the greatest factor in reducing infant mortality will be that of teaching the mothers to feed the babies rationally, yet we feel confident that the detection and the shutting out of all supplies which show infected milk is a factor of but little less value. The value of artificially soured milk for sick as well as for normal infants is well known, and we do not feel that plate counts discriminate between these and truly dirty milk as does the smear method.

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